Geraghty & Miller, Inc.

PRESENCE OF URANIUM IN THE GROUND WATER, SURFACE WATER, SOILS, AND SEDIMENTS IN THE BEAR CREEK VALLEY WASTE DISPOSAL AREA

Prepared for

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Oak Ridge, Tennessee

September 1985

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1.0 INTRODUCTION

1.1 PURPOSE

In September 1985, Martin Marietta Energy Systems, Inc., (Energy Systems) requested Geraghty & Miller, Inc., (G&M) to prepare this report on uranium detected in ground water, surface water, soils, and sediments in the Bear Creek Valley Waste Disposal Area (BCVWDA) at the U.S. Department of Energy's Y-12 Plant in Oak Ridge, Tennessee. The report is essentially a summary of references to uranium contained in G&M's June 1985 report to Energy Systems entitled "Remedial Alternatives for the Bear Creek Valley Waste Disposal Area."

1.2 LOCATION OF THE BCVWDA

The BCVWDA consists of three principal waste-disposal sites, the S-3 Ponds, the Oil Landfarm, and the Burial Grounds, situated over a distance of roughly two miles in the valley of Bear Creek (Figure 1). The valley, which extends in a general west-east direction, is bordered on the north by Pine Ridge and on the south by Chestnut Ridge. Bear Creek flows westward through the valley to drain into East Fork Poplar Creek, which empties into Poplar Creek, a tributary of the Clinch River. The underlying bedrock formations consist largely of stratified shales and limestones, overlain by unconsolidated soil materials derived from weathering of those rocks. The BCVWDA has been used since 1951 for

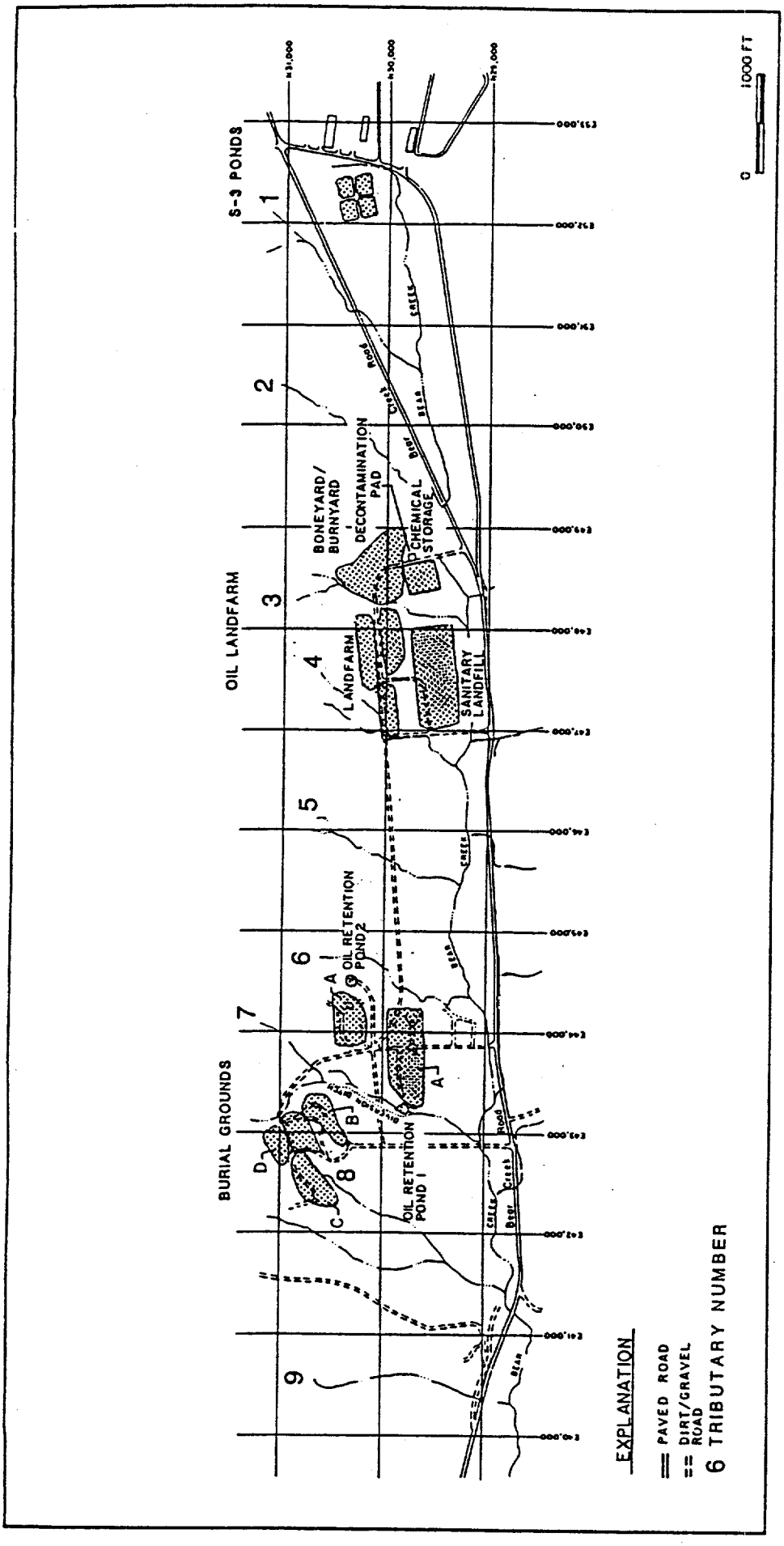

FIGURE 1. BEAR CREEK VALLEY WASTE DISPOSAL AREA

disposal of a wide variety of wastes, some of which contained residues of uranium.

An extensive monitoring network is in place at the waste-disposal areas to detect contaminants. The network includes more than 150 monitor wells and about 25 surface-water stations, all of which have been sampled periodically for chemical analysis. The following sections of this report deal exclusively with evidences of uranium contamination at these monitoring points and in soils and sediments.

2.0 WASTE-DISPOSAL AREAS

2.1 S-3 PONDS

The S-3 Ponds were built in 1951 as a disposal site for liquid wastes. In the 1950's uranyl nitrate solutions containing trace amounts of transuranics and other fission products were placed in the ponds. At later dates, depleted uranium in nitric acid solutions, raffinate and condensate containing technetium and transuranics, as well as small lots of miscellaneous solid materials, were added. The inventory list includes dilute acids, machine coolants, caustic solutions, biodenitrification sludges, and concentrated acids.

2.2 OIL LANDFARM

The Oil Landfarm was first used for disposal of waste oils and coolants in early 1973, and the site remained in use until 1982. Prior to 1979, the waste oils and coolants were not specifically analyzed for contaminants before application to the Oil Landfarm. A program for analysis of oil samples for uranium, beryllium, thorium, and PCBs was then implemented. For the purposes of this document, the Oil Landfarm site also includes the Boneyard, Burnyard, Sanitary Landfill, Decontamination Pad, and the Chemical Storage Area.

2.3 BURIAL GROUNDS

The Burial Grounds encompass several principal sites designated as Burial Grounds A, B, C, and D and two Oil

Retention Ponds. Each burial ground consists of a series of trenches. The first trench in Burial Ground A was excavated in August 1955 for the disposal of solid wastes. In July 1959, the Y-12 Plant began using this facility for the disposal of liquid wastes from floor cleaning operations, referred to as mop waters. Additional wastes disposed of in the Burial Grounds were heavy metals, including beryllium and uranium, oils and coolants, salts, debris, solvents, EDTA, asbestos, and materials contaminated with radioisotopes.

Burial Ground B was opened in 1962 for the disposal of depleted uranium metal and oxides. Burial Ground C was opened in 1962 for the disposal of beryllium, beryllium oxide, thorium, and solid waste contaminated with these materials; other materials contaminated with enriched uranium also were disposed of in Burial Ground C. Burial Ground D was used after 1968 for the disposal of depleted uranium metals and oxides after Burial Ground B had reached capacity. An area of the Burial Grounds referred to as the Walk-In Pits was used from 1966 to 1981 for the disposal of chemicals and uranium metal saw fines. Since 1981, the Walk-In Pits have been used solely for the disposal of uranium metal saw fines.

3.0 PRINCIPAL AREAS OF CONTAMINATION

3.1 OVERVIEW

The variability of the wastes placed in the BCVWDA over a period of more than 30 years, reflecting changes in manufacturing processes and waste-treatment methods at the Y-12 Plant, does not permit the delineation of plumes of contamination in ground water attributable to specific sources of wastes. The contaminants, however, may be grouped in four broad categories (nitrate, radioactivity, heavy metals, and volatile organic compounds), nearly all of which are present in ground water at the three major disposal areas and, locally, in surface water, soils, and sediments.

The areal extent of ground water contaminated by uranium activity in the BCVWDA is shown in Figure 2. The map depicts average conditions in 1984; boundaries of the plumes are only approximate and the contaminant concentrations at shallow depths may vary seasonally in response to the infiltration of rainfall. The vertical extent of contamination is presently being investigated through the sampling of recently installed deep monitor wells.

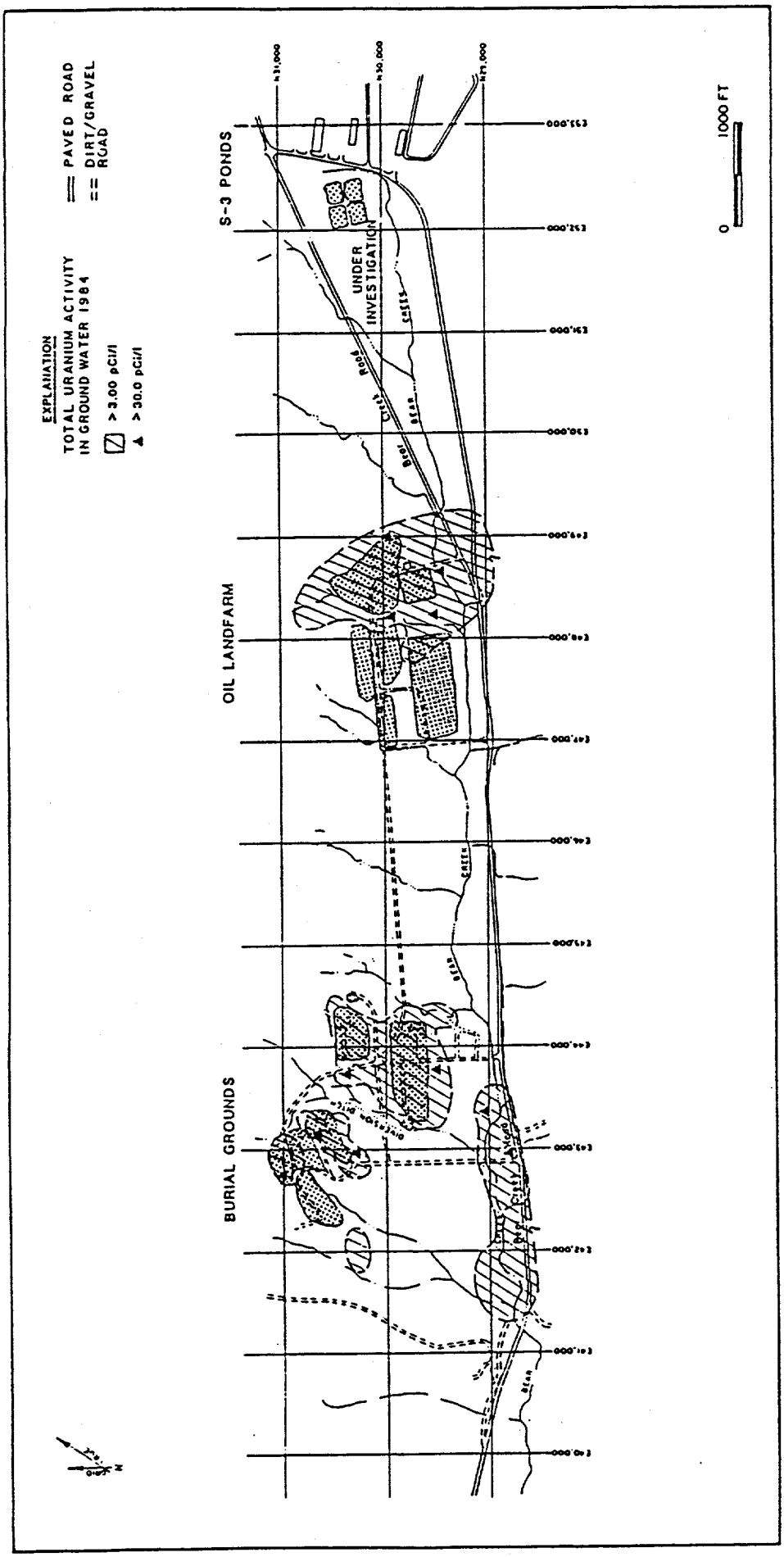

FIGURE 2. APPROXIMATE AREAS OF GROUND-WATER CONTAMINATION BY URANIUM ACTIVITY.

3.2 S-3 PONDS

3.2.1 Ground Water

An investigation of the presence of uranium in ground water at this site is currently under way, and the results should be available by late 1985.

3.2.2 Surface Water

Figure 3 indicates the total uranium activity in 1984 at sampling stations on Bear Creek and its tributaries. The analytical data suggest that ground-water seepage from the S-3 Ponds accounts for the radioactivity detected in upper Bear Creek. At sampling station 1-1, about 1,800 ft downstream of the ponds, water from Bear Creek contained 276 pCi/l (picocuries per liter) of total uranium activity. Samples from stations farther downstream contained lower amounts, presumably reflecting dilution.

3.2.3 Soils

Historical data on radionuclides in soils at this site are limited. However, a recent survey near the ponds showed uranium concentrations ranging from 2.2 to 186 ppm (parts per million) in soils (personal communication, R.R. Turner, Energy Systems, 6/13/85).

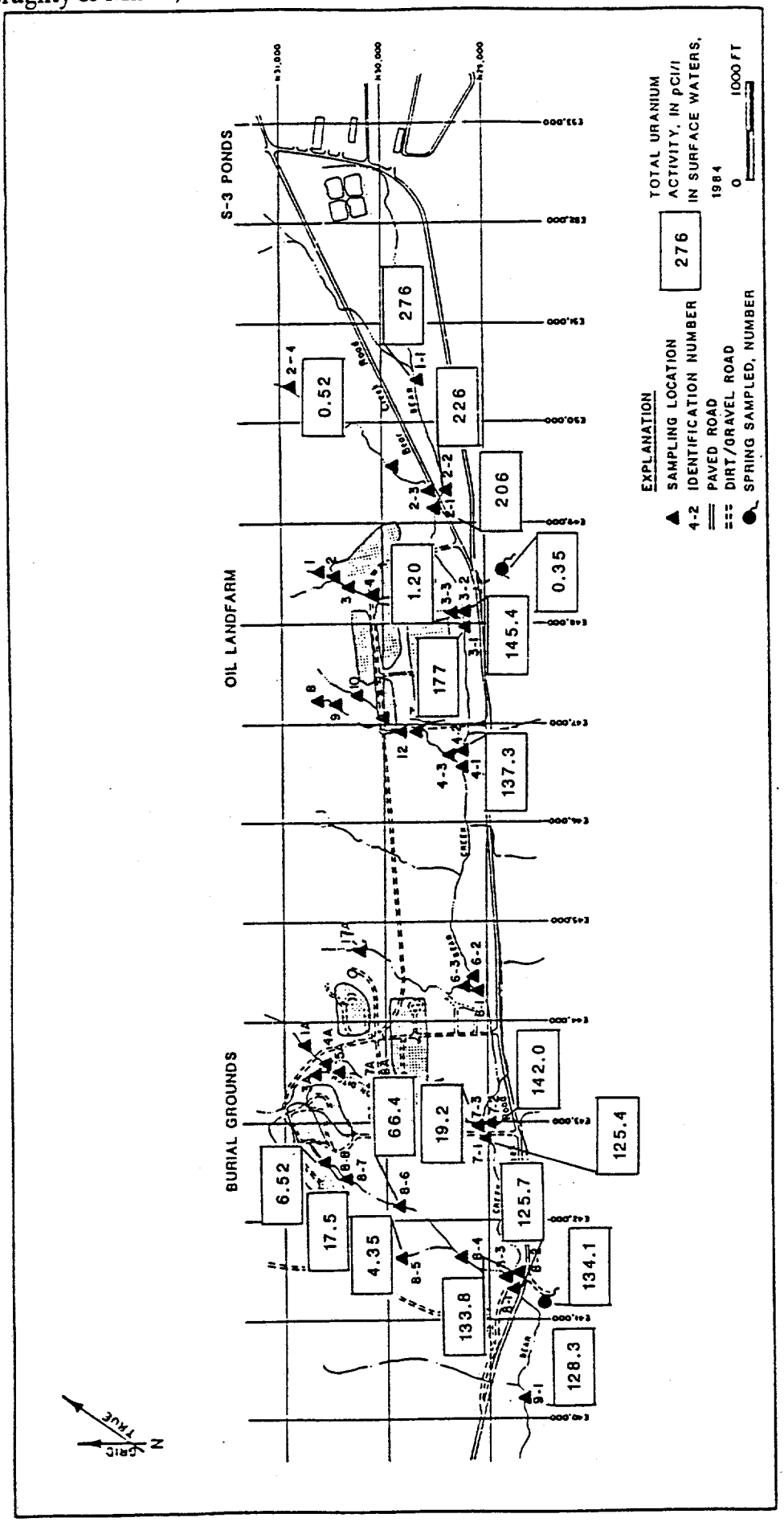

FIGURE 3. TOTAL URANIUM ACTIVITY IN SURFACE WATER

3.2.4 Sediments

Only limited data are available on radionuclides in sediments near the headwaters of Bear Creek (see Figure 4). One recent study of sediment samples from four sites on upper Bear Creek, two of which are small impoundments, showed uranium concentrations ranging from 100 to 4,900 ppm.

3.3 OIL LANDFARM

3.3.1 Ground Water

Areas of relatively high uranium activity in ground water are shown in Figure 2. The highest levels, determined in the vicinity of the Decontamination Pad, ranged from 34 to 395 pCi/l. The vertical distribution of total uranium activity at the Oil Landfarm is shown in two cross sections, Figures 5 and 6.

3.3.2 Surface Water

Total uranium activity in surface water is shown in Figure 3; as indicated, samples from downstream stations contained lower levels of uranium than samples from upper Bear Creek.

3.3.3 Soils

Inorganic contaminants detected in soil borings in the Oil Landfarm area at levels elevated over background include

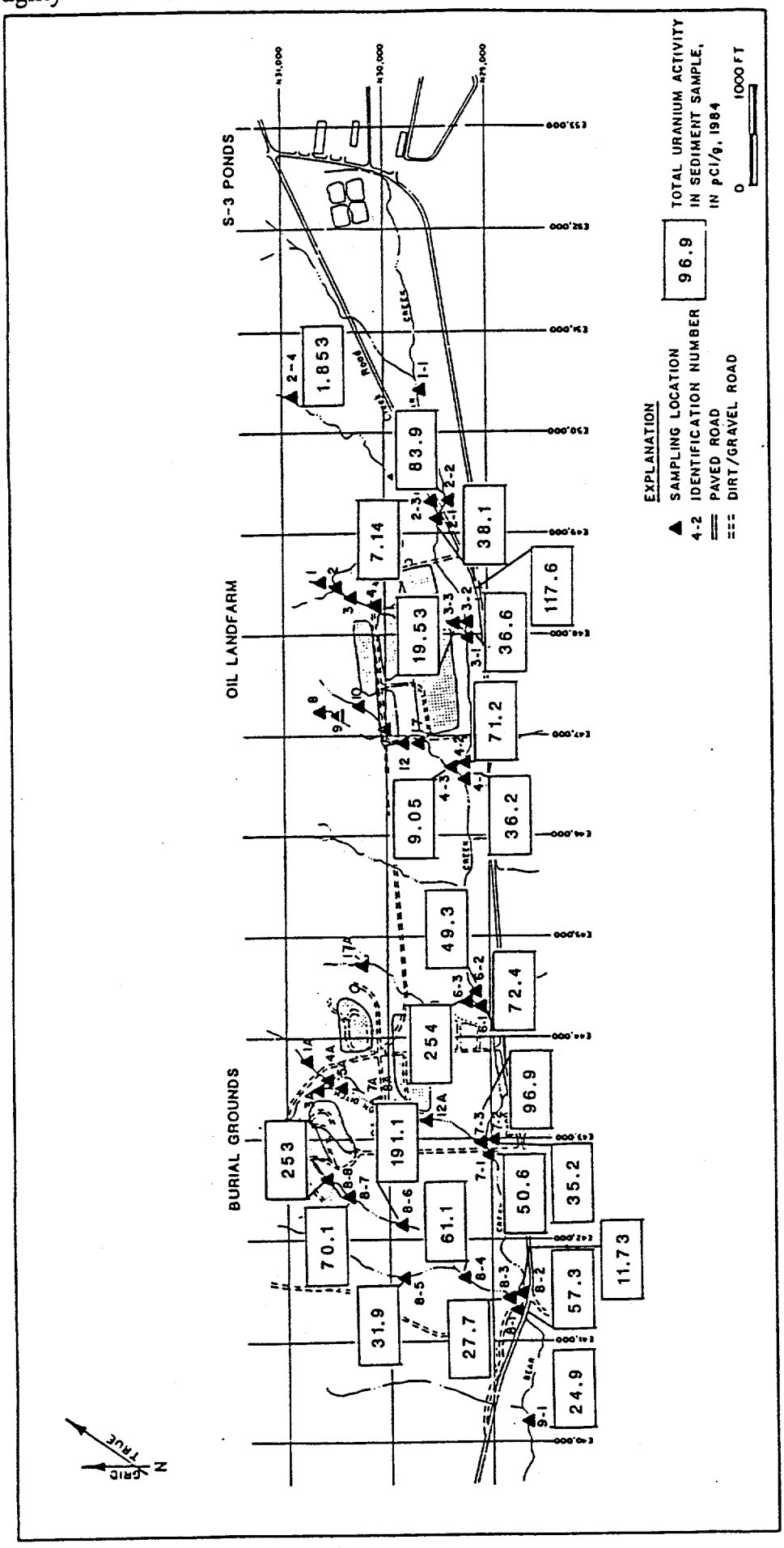

FIGURE 4. TOTAL URANIUM ACTIVITY IN STREAM SEDIMENTS

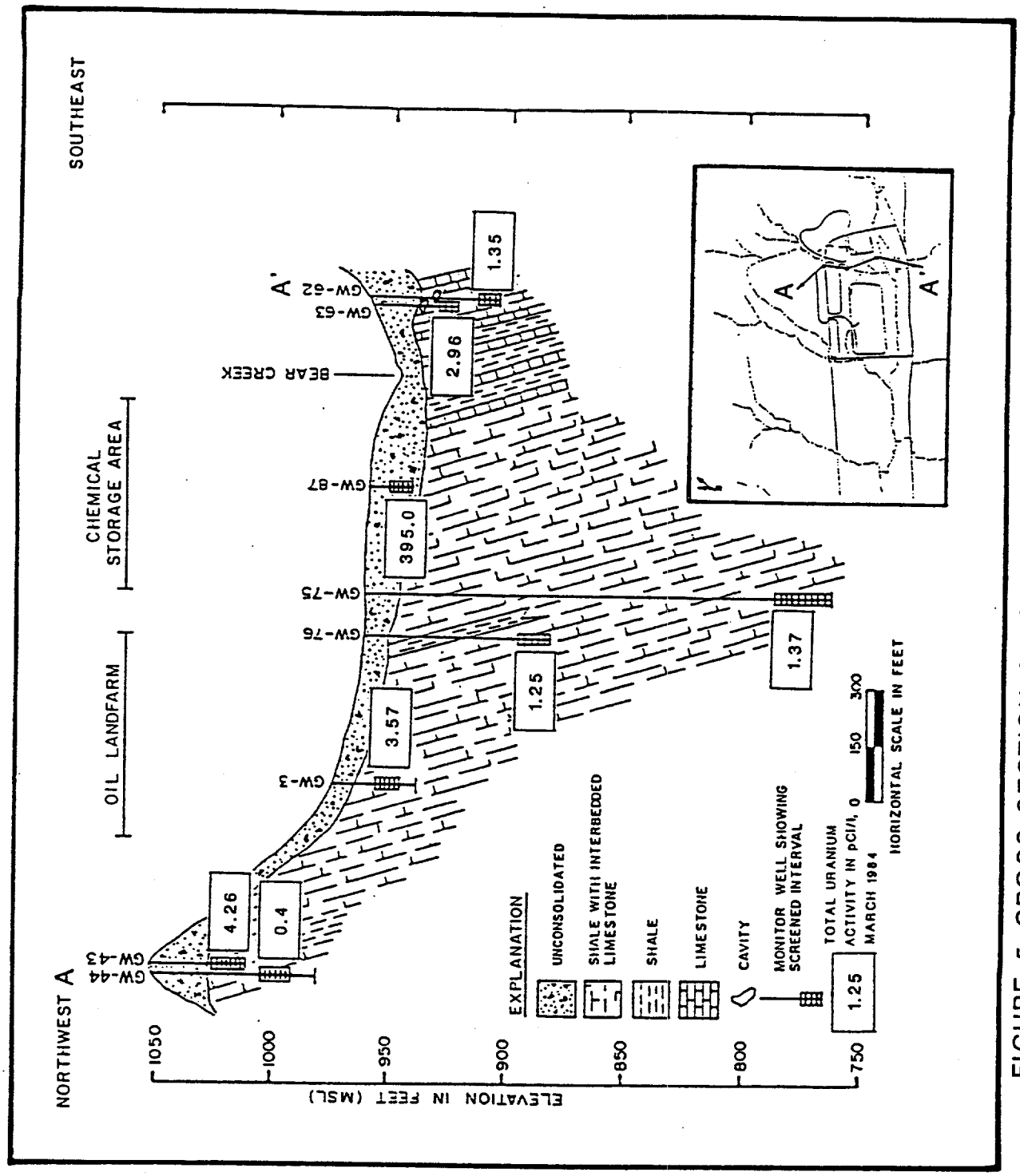

FIGURE 5. CROSS SECTION A-A' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE OIL LANDFARM

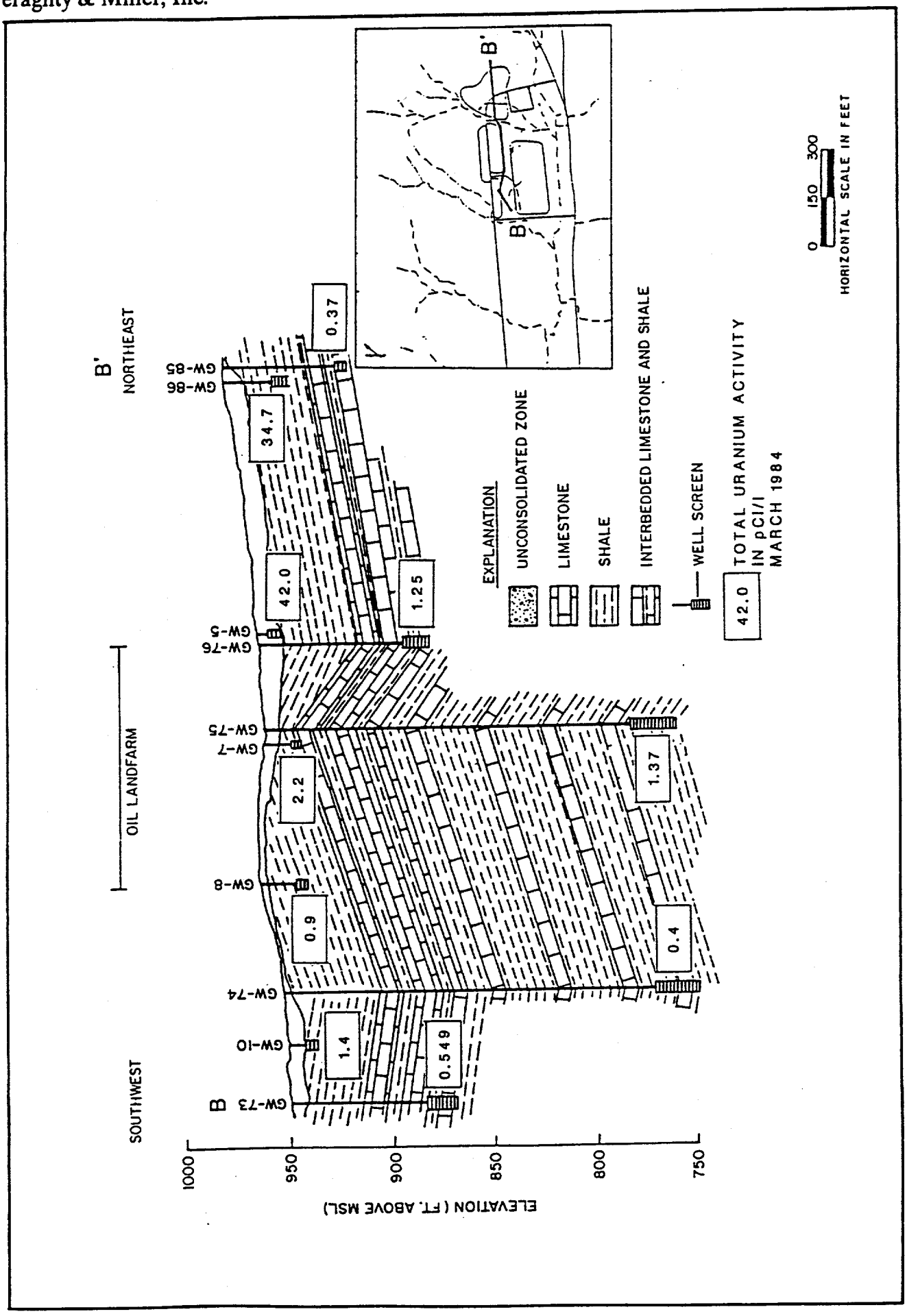

FIGURE 6. CROSS SECTION B-B' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE OIL LANDFARM

antimony, arsenic, cadmium, copper, and lead; the limited data available indicate only slight contamination by uranium.

3.3.4 Sediments

Total uranium activity in the stream channels in this area is somewhat elevated, as shown in Figure 4.

3.4 BURIAL GROUNDS

3.4.1 Ground Water

Areas of relatively high radioactivity of ground water are shown in Figure 2; these comprise Burial Ground A, isolated areas at Burial Grounds C and D, and an area adjacent to Bear Creek. Within each area, there are instances of total uranium activity in excess of 30 pCi/l; values as high as 541 pCi/l have been determined. The vertical distribution of total uranium activity at the Burial Grounds is shown in two cross sections, Figures 7 and 8.

3.4.2 Surface Water

Scant available data indicate that samples from upstream sections on Tributary 8 have elevated concentrations of uranium as well as of boron, lithium, barium, and strontium. Most of these constituents apparently become diluted in the lower courses of the tributaries and do not seem to contribute significantly to the contaminant load of Bear Creek, which is derived largely from sources upstream. Total

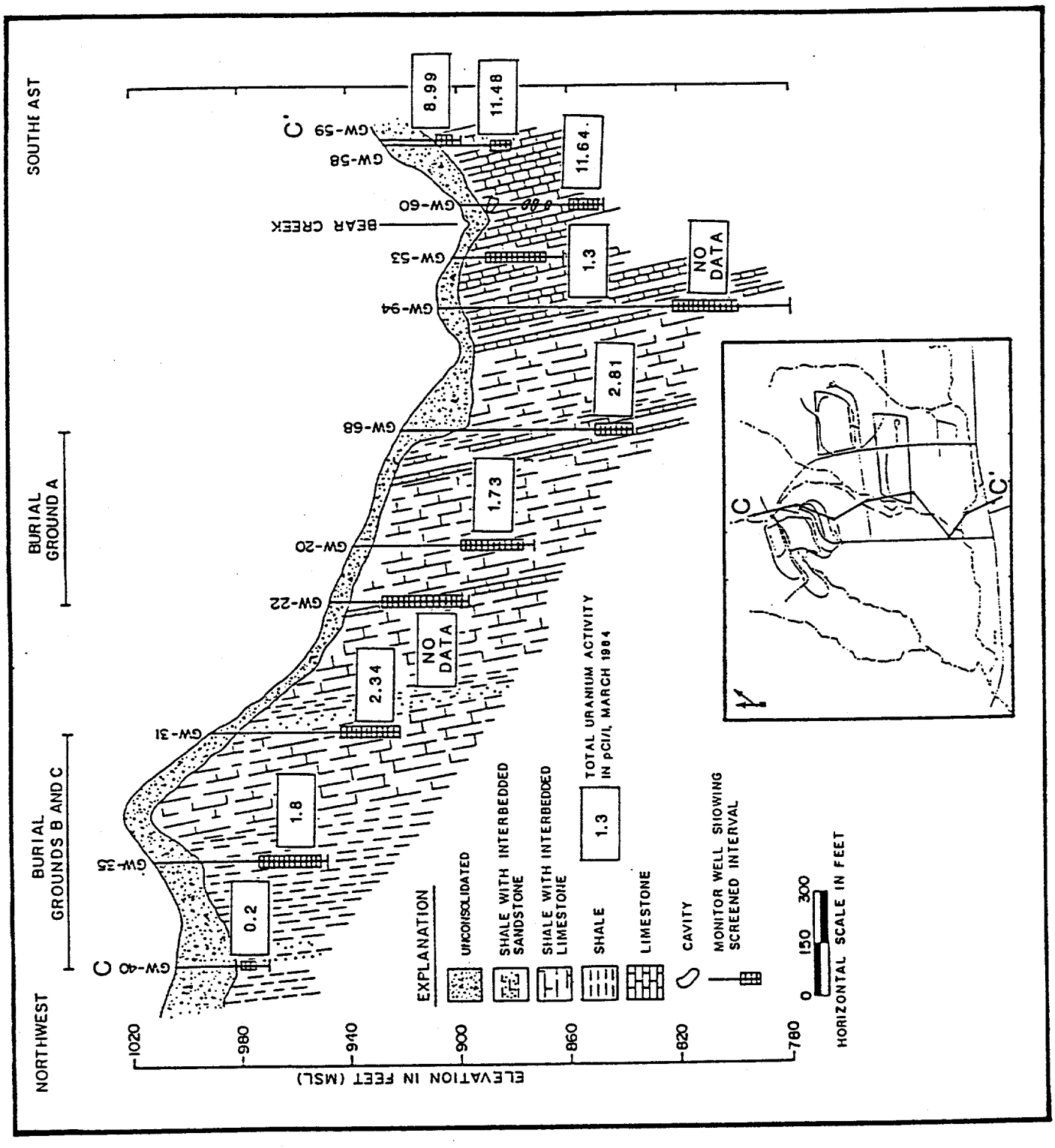

FIGURE 7. CROSS SECTION C–C' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE BURIAL GROUNDS

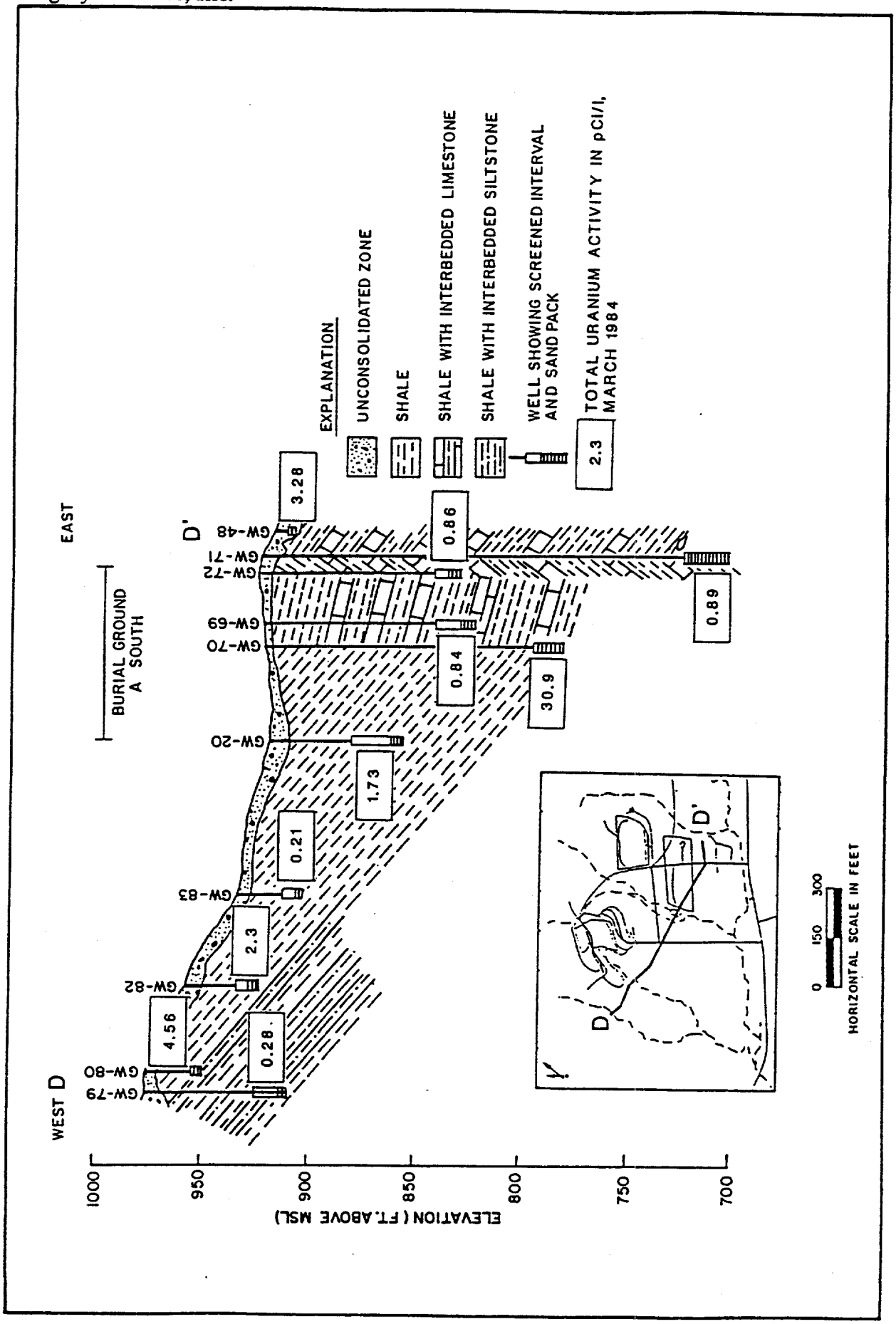

FIGURE 8. CROSS SECTION D-D' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE BURIAL GROUNDS

uranium activity in surface water in April 1984 is shown in Figure 3.

3.4.3 Soils

Uranium in soils at the Burial Grounds was only slightly elevated above background values.

3.4.4 Sediments

Elevated uranium content has been noted in sediment samples from most stations on Tributaries 6, 7, and 8, as shown in Figure 4. There are isolated instances of concentrations of up to 3,000 picocuries per gram (personal communication, R.R. Turner, Energy Systems, 6/13/85).

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